Canadian Institute for International Peace and Security

Institut canadien pour la paix et la sécurité internationales

WORKING PAPER 23

CLIMATE CHANGE, GLOBAL SECURITY, AND INTERNATIONAL GOVERNANCE

A SUMMARY OF PROCEEDINGS OF A CONFERENCE ON CLIMATE CHANGE AND GLOBAL SECURITY OTTAWA, 11 - 12 APRIL 1990

by Kenneth Bush

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360 Albert Street, Suite 900
Ottawa, Ontario
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ISBN 0-662-17410-0

90-07058/

PREFACE

Environmental issues have grabbed the spotlight of public attention. Paradoxically, in contrast to the doom and gloom scenarios on the nature and extent of environmental degradation, there has been relatively little discussion, in practical policy terms, of what can or should be done to address environmental problems within the context of global security and international governance.

The Canadian Institute for International Peace and Security assembled a wide range of decision makers and experts, on 11 and 12 April, to discuss the nature of climate change, its ecological, social, political and economic consequences, and possible policy responses at regional, national and international levels. The conference was organized by Nancy Gordon, Director of Public Programmes at the Institute, and Fen Osler Hampson, a Research Associate. They were ably assisted by Margaret Bourgeault, Jill Tansley and Samantha Hayward. This report presents an overview of the major issues addressed during the conference. It is organized by theme, rather than in the chronological sequence of events. Appendix II contains the programme and Appendix III a list of conference participants.

Kenneth Bush, a graduate of Carleton University, is now a doctoral student in the Government Department of Cornell University: he acknowledges, with gratitude the excellent editorial assistance he received from Marcia Rodriguez, in the preparation of this text.

Working papers, the result of research work in progress or the summary of a conference, are often intended for later publication by the Institute or another publisher, and are regarded by the Institute to be of immediate value for distribution in limited numbers -- mostly to specialists in the field. The opinions contained in the papers are those of the participants and do not necessarily represent the views of the Institute and its Board of Directors.

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EXECUTIVE SUMMARY

The conference focussed on the political, social and economic consequences of climate change. There was little disagreement on the basic processess and geophysical effects of climate change, which include changes in temperature, amount and distribution of precipitation, storm frequency and intensity, and sea level.

That the world's economy and ecology are now totally interlocked, was an underlying theme of the Conference. This linkage raised fundamental questions about how policy decisions are taken and their implications for ecological sustainability. While the scope for possible action may grow with technological developments, it is very clear that the obstacles to sustainability are not technical or even economic: they are social, institutional and political.

At the 1988 Toronto Conference on the Changing Atmosphere sponsored by the Canadian Government, the United Nations Environment Programme and the World Meteorological Organization, there was a call for a twenty percent reduction in global carbon dioxide emissions (from 1988 levels) by the year 2005. Since then, worldwide emissions have increased by approximately six percent and the likelihood of meeting the target is increasingly doubtful. As Christopher Flavin of the Worldwatch Institute pointed out at the Ottawa conference, the twenty percent goal was formulated on the basis of what the climate needs, not what politicians are ready to accept or what economists are willing to put into their econometric models.

Because energy use is the principal source of atmospheric contaminants, energy is viewed as the crux of the problem. An effective response to climate change, Flavin argued, must recognize two things: energy politics is "hardball politics" dominated by a handful of powerful industries and interests; and economic soundness and market forces must be the guiding force in determining appropriate technologies and strategies. There was a strong call at the conference for a political and economic "levelling of the playing field." Subsidies attracted particular attention. According to Jim MacNeill, "When you compare $40-50 billion a year [for subsidies] in North America to promote fossil fuels, and hence to promote acid rain and global warming, with the decreasing amounts spent

on efficiency and alternatives to fossil fuels, it is no contest. Acid rain and global warming win hands down."

The argument that economic soundness and market forces should be a guiding principle of environmental policy action raised the more fundamental and contentious question of whether subsidies should be a policy instrument at all and, if so, what activities should be subsidized. Mr. MacNeill reflected a view shared by a number of delegates when he argued that subsidies encouraging ecologically damaging production processes, such as the OECD agricultural subsidies which reinforce the overuse of soils, wood, as well as other resources and ecological capital, should be either scrapped or made ecologically sensitive. Another facet of the argument was presented by Flavin, who argued both that the levelling of the playing field would require that the current subsidization of ecologically unsound production be stopped and that limited subsidies be made available to ecologically sound production and technologies. The third facet of the argument was that a subsidy is a subsidy and therefore levelling the playing field would require that all subsidies be stopped. The debate, though animated, was inconclusive.

Peter Gleick of the Pacific Institute focussed the concern of the conference on the relationship between climate change and international conflict. He pointed out that while the impacts of climate change will be fairly evenly distributed among nations, the ability to respond and adapt differs between the rich and poor countries. This disparity is already causing some tension between North and South and may become a principal source of conflict in the years to come. More generally, where international tensions already exist, the impact of climate change on resource availability and quality may trigger conflicts. For example, the 1967 war in the Middle East was caused partly by the question of access to the Jordan River. The dynamic is also evident in Central America, the Horn of Africa, South Asia, and elsewhere.

The further deterioration of North-South relations was another prominent underlying theme of the conference. As the Cold War wanes, a new type of power logic may be emerging, pitting poor nations against rich nations with environmental change providing much of the leverage the South needs to get a fair deal from the North on economic and equity questions. Some developing countries have clearly come to the conclusion that the second wave of environmental concern now sweeping Europe, North America and Japan, provides them with political leverage, however negative, which they can use in bargaining for action on those things that concern them most.

The rapid population growth and increasing energy use of developing countries reinforces the point that the industrialized world cannot deal with global warming on its own. Rich nations will have to begin to address other issues of crucial importance to developing countries if meaningful international agreements on the environment are to be concluded and implemented. These include the issues of resource sharing; financial burden sharing; debt reduction; trade access; and preferential access to intellectual property and technology.

The policy choices and action we take now will be played out in future climate trends. Even if every individual on the planet were transformed into an ecologically rational animal, there would still be a lag between societal action and global ecological reaction due to the sheer momentum of climate change. The concentrations of greenhouse gases will continue to build up in the atmosphere and the longer it takes to deal with them, the more climate change we will be committed to.

The broad scope of ideas for action and policy options is suggested by the following shortlist of options: creation of new indices of climate change and sustainable development to measure how well we are tackling environmental problems; the use of remote sensing as an early warning mechanism of environmental problems; an expanded role for international institutions; the creation of a world atmospheric trust fund; a tax on carbon emissions; use of regulatory and economic incentives; and reforestation.

The statement of the 1988 Toronto Conference warns that: "Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences may be second only to a global nuclear war." In the search for a bottom line, it was clear among most participants that the cost for action is far less than the costs of inaction. The response to the "unintended experiment" of climate change, if it is to be effective, must be rooted in the social, economic, and political as well as the scientific.

INTRODUCTORY REMARKS

Bernard Wood

Bernard Wood, Chief Executive Officer of the Canadian Institute for International Peace and Security, opened the conference with an overview of some of the major issues associated with climate change, global security, and international governance. He pointed out that effective responses to climate change will require strategies of both prevention and adaptation. In this process, the allocation of the costs and benefits of action and inaction was expected to be the source of human struggle and conflict. It is clear that resource and environmental pressures can contribute to the outbreak of war, having already had this impact in many parts of the world such as Central America, the Horn of Africa, and the Middle East. Natural increases in resource demand as a result of population growth and increased consumption threaten further competition and conflict. Mr. Wood also identified environmental refugees as additional evidence of the effects of changing climate on conflict. He warned that diverse climate change could increase the stakes dramatically.

In pointing to the need for international cooperation, Mr. Wood raised a central question of whether this new global challenge can be met using existing institutions such as the United Nations, whether these must be modified, or completely new institutions created. He argued that regardless of the institutional options pursued, the response must be equitable and sensitive to the different needs, resources, and responsibilities of both the industrialized countries and the developing world. The industrialized world's track record, he noted, has not been encouraging in building truly effective multilateral cooperation, and North-South cooperation in particular.

Mr. Wood concluded with a discussion of political constraints and opportunities. He pointed out that multilateral institutions and international non-governmental bodies can go no further than the collective will of their national governments. Mr. Wood was confident, however, that the "will of ordinary people" to manage the threat of climate change is becoming increasingly apparent. In stressing the urgency of the problem, he

ended by questioning whether governments will take up the challenge now, or wait until they are pushed to the brink of crisis and beyond.

1 THE SCIENCE OF CLIMATE CHANGE

There was no disagreement that the composition of the atmosphere is changing or that the gases responsible for climate change, especially carbon dioxide (CO_2), methane, nitrous oxide, and the chlorofluorocarbons (CFCs) are increasing at an exceedingly rapid rate. The overall "forcing functions" of climate change, underpinned by world population growth, were identified as increasing fossil-fuel use, agriculture and land-use changes, urbanization, and the introduction of chemicals for which there are no natural analogues.

The main categories of atmospheric pollutants are the greenhouse gases, the ozone layer depleters,[1] the acidic compounds such as sulfur dioxide (which contribute to acid rain), and the metals and organics that are toxic at higher concentrations as they accumulate in the food chain. The dominant source of the major contaminants in all categories is energy production and energy use. Jim Bruce, an advisor to the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), noted that nearly two-thirds of CO_2 emissions come from these sources. According to Michael McElroy of Harvard University, about 5 billion tons of carbon are produced annually in the form of CO_2 by burning coal, oil, and natural gas on a global scale: 1 ton per person on earth. In the industrialized world it is even higher; for the United States, it is almost three times higher than the global average. Although CO_2 is invisible and non-toxic, it is still the largest single human waste product. Mr. Bruce noted that about a million years' worth of naturally produced fossil-fuel deposition is extracted and consumed every year, producing more than 80 percent of the nitrous oxide emitted. A substantial portion of CFC emissions and most sulfur dioxide emissions are also related to energy use and production. It was also noted that the major portion of

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[1] The man-made CFCs are implicated in stratospheric ozone depletion, but they too trap heat and are increasing at rates, in some cases, as high as 10 percent per year. Carbon dioxide emissions remain the principal cause of the greenhouse effect.

toxic metals (mercury and lead) that now "infect" ecosystems from the Arctic to the Antarctic are transported on the winds of the atmosphere. Mr. Bruce described the transnational character of these atmospheric contaminants as "the democracy of the winds."

The Increase in Carbon Emissions

Richard Richels of the Electric Power Research Institute (EPRI) added that global carbon emissions have increased at an annual rate of 3.2 percent since 1950, the absolute level of emissions rising from 1.6 to 5.7 billion tons of carbon. There has also been a substantial shift in the pattern of global contributions. For example, in 1950 North America and Western Europe accounted for 68 percent of total emissions. By 1980 their share had fallen to 43 percent. In contrast, the portion attributable to China and other developing countries in Latin America, Southeast Asia, and Africa rose from 7 percent to 20 percent over the same period. In the absence of an international agreement to limit growth, carbon emissions are expected to increase considerably, perhaps by a factor of four or more over the next century. During this period, there is likely to be a significant shift in the regional patterns of emissions. By 1990 the industrialized countries accounted for 71 percent of man-made carbon emissions. By 2100 their share is expected to drop below 50 percent.

Deforestation was also recognized as a small but significant contributor to the increase in atmospheric CO_2 with a contribution of approximately 1 billion tons per year, or 20 percent of the overall total. According to Dr. McElroy, the soils and the biosphere appear to be important CO_2 reservoirs. If the soils <u>are</u> carbon sinks, there may be a possible linkage with acid rain. Dr. McElroy stressed the speculative nature of such a linkage, but the possibility suggests the need for integrated policies in order to deal with interlink environmental problems; for example, acid rain policy may need to consider its impact on the effects of carbon emissions.

The Increase in Methane

Turning attention to other gases responsible for climate change, Dr. McElroy explained that the reasons for the rise of methane are not clearly understood since conventional explanations, such as the rise in cattle and in rice cultivation, cannot account for the observed increase. In his view, this increase in methane levels is an early warning of climate change itself, which suggests that the self-cleansing attributes of the atmosphere may be slowing down.

Policy Responses

Dr. McElroy suggested that scientists and policy makers have had a tendency to become the victims of simple models in the assessment of the impact on climate of greenhouse gases. He stressed that much could be learned by studying the climate of the past. The belief that the earth is "somehow or another indestructible" is not a scientific view, but an emotional one. We can change, and are changing, the composition of the atmosphere.

In developing firm policy responses to these issues, Dr. McElroy argued that we must at least anticipate the possibility of scenarios which will be worse rather than better than we think. He emphasized the need to develop new and better indices of global climate change rather than relying on only one parameter such as the global average temperature. He suggested an indicator that would measure the height of the tropopause (the top of the region of weather over the earth). If varying heights of the tropopause are in fact related to historical instances of severe climate change, Dr. McElroy concluded that it may be possible to monitor processes within the global climate system by observing this one indicator. He emphasized that this indicator was still only an idea and that there may be alternative climate indices. Identifying these indices could help in developing "early warning systems" of climate change. Prudent policy, at a minimum,

should address the issue of the changing composition of the atmosphere and the rapid pace of change, with a view to slowing down the pace of that change.

Predicting Climate Change

In order to develop a sense of how vulnerable our planet may be, Fred Roots, Science Advisor Emeritus to Environment Canada, presented a brief history of the earth. There have been many profound changes on the earth in its 5 billion year history and, at least five times in the last 5 million years, there have been sudden and catastrophic mass extinctions.

Of the many hypotheses that have been put forward to explain these and other catastrophes, the most plausible, in Dr. Roots's view, is the superimposition of a rapid, worldwide change in environmental conditions on an already stressed and overloaded system. These changes in the distant past illustrate that conditions on earth have not always been as they are today and that marked changes now or in the future are possible. They also provide the only examples available of large-scale environmental and biological responses to change. Some of these examples suggest that when conditions become stressed, quite small changes in ordinary events may lead to overall significant changes.

Effects of Climate Change

The basic physical processes and scientific measurements of climate change were viewed as "fairly sound." But the enormous complexity and variability of the environmental response was subject to greater speculation. Dr. Roots outlined the general areas of agreement on the effects of a global rise in temperature. He also described some of the likely impacts of climate change in several areas including changes in precipitation patterns and major atmospheric circulation patterns as well as significant changes in hydrology.

Dr. Roots stressed that the effects of all these changes on vegetation, forests, agriculture, and natural ecosystems are of prime importance to humans. In the absence of human intervention, global warming alone would cause the bio-geographical zones, that is, those areas favourable towards certain types of biological production, to move north. In North America and Eurasia, the shift would be about a hundred kilometres for each one degree C rise in the annual temperature. In marine areas, the net temperature change is generally assumed to be less than that on land because of the thermal inertia of water and its ability to transfer heat rapidly in three dimensions or lose it through intense evaporation. Here again, small changes may cause profound differences in ocean behaviour and disrupt the world's marine biological productivity.

Dr. Roots concluded that even slight global warming can have severe worldwide consequences, resulting in a planet stressed physically, chemically, and biologically. The consequence of these issues, he said, is the rise of a widespread feeling in the scientific community that international cooperation is essential in understanding what is happening. The question remains whether or not we will be "participants and victims of the experiment or whether we can control it."

Climate Change and Forestry

Jag Maini of Forestry Canada examined the connections between forest ecosystems and global warming, as well as the significance of the rate of global warming, which is much faster than anything the biological world has yet experienced. He pointed out that over the last 8,000 years the estimated total global area of forest dropped from 6 billion hectares to its present estimated area of 4 billion: about one-third of our total forest cover has been lost. Dr. Maini believed that in some parts of the boreal forests growth will be enhanced; in other parts growth will be decreased, but "the overall balance suggests that it will not change very much." Clearly, however, different regions will be affected in different ways. This is particularly important for the countries with the largest forest resources: Canada, the United States, South America, the Soviet Union, and

Africa. Because climate change will be more severe in the middle latitudes, Canada, the United States, and the Soviet Union will be the most dramatically affected.

Dr. Maini identified the impact of climate change on forest fires as an area of particular importance. He concurred with Dr. Roots that dry areas are likely to get drier. Because the growth of insects, disease, and fire are climate driven, global warming was expected to increase the incidence of forest fires considerably. Certain areas of Canada such as the Prairies and the Okanogan Valley were identified as particularly prone to fires. If the climate changes by one degree C or more, these zones will move farther north.

Dr. Maini also expected an increase in disease and insect infestation because Canada's warmer climate would become a less effective barrier to the survival of certain pests. In response to these changes, forest harvesting technology and watershed management would need to be adjusted. Dr. Maini argued that these issues should all be examined in greater detail because they will have major implications for investment patterns and consequences for Canada's returns on investments.

II THE INTERFACE OF SCIENCE AND POLICY

Peter Gleick of the Pacific Institute pointed out that to deal with climate change, and particularly with the interface of science and policy, a new language must be appropriated and applied. While acknowledging the geophysical effects of climate change, he identified his concerns as the range of political, social, ecological, and economic impacts that climate change brings. The nuances of the science-policy interface were further examined by Jim MacNeill of the Institute for Research on Public Policy. Drawing on his considerable experience in issues of environment and development, he described how the world has moved beyond economic interdependence to ecological interdependence; and even beyond that to a complete intermeshing of the two. He called global warming a form of feedback from the earth's ecological system to the world's economic system. To ignore one system today, he warned, is to jeopardize the other, since the world's economy and the world's ecology are now "totally interlocked." This interrelationship raises fundamental questions about how economic and political decisions are taken and their implications for ecological sustainability. While the horizons of possible policy options may grow with technological opportunity, it was very clear to Mr. MacNeill and many others that the obstacles to sustainability are not technical or economic; they are social, institutional, and political.

The Economics of Energy

The costs of responding to climate change were addressed throughout the conference. Discussion was at times animated when the underlying assumptions of cost estimates were examined. Injecting a note of caution into the discussion, Bert Metz of the Royal Netherlands Embassy in Washington warned that formal cost models may be dangerous: "What you put in is what you get out."

The Costs of Limiting Carbon Emissions

Dr. Richels presented the findings of his study on the costs of implementing a reduction in global carbon emissions. He pointed out that this information is important to policy makers in assessing the feasibility and cost-effectiveness of various strategies. He emphasized that the study was not a cost-benefit analysis and focussed only on carbon emissions from the energy sector. Although there was disagreement over appropriate levels of reduction, the consensus was that the burden will fall disproportionately on industrialized nations. Dr. Richels said that if global income inequalities diminish, developing countries will experience much faster rates of economic expansion and growth in energy demands than their currently industrialized counterparts. It was recognized that developing nations are unlikely to accept any agreement that fails to provide for some increase in their carbon emissions. For them, the issue will be how far to limit increases in emissions, a point reiterated throughout the conference.

Dr. Richels's model assumed that the industrialized countries would agree to stabilize carbon emissions at their 1990 level through the year 2000, gradually reducing them by 20 percent by the year 2020; the developing countries would limit emissions to twice their 1990 levels. Overall, the proposed limit would lead to a 15 percent increase in global emissions between 1990 and 2030, but no further increase thereafter. By 2100 the emissions level would be 75 percent less than it would have been in the absence of an international agreement.

The following costs for reducing carbon emissions were estimated:

The United States: By 2030 a loss of roughly 3 percent of the total annual Gross Domestic Product (GDP).

Organization for Economic Cooperation and Development (OECD) Countries: Measurable macroeconomic consequences do not begin to accrue until 2010; annual losses in total consumption limited to the 1 to 2 percent GDP range.

The Soviet Union and Eastern Europe: By 2030 a loss of roughly 4 percent of macroeconomic consumption.

The Third World: Since this category includes the Organization of Petroleum Exporting Countries (OPEC), Mexico, and other potential oil exporters, the costs of a carbon constraint calculated as negligible until 2020; by the end of the 21st century, an expected loss of approximately 5 percent of GDP.

China: Expected to be most heavily affected by the international carbon reduction agreement; annual GDP losses predicted to exceed 10 percent by the latter half of the 21st century.

Dr. Richels argued that any increase by developing countries would need to be offset by reductions in the industrialized countries. It was calculated that if China and the developing countries were allowed to double emissions, the industrialized countries would need to reduce emissions by nearly 70 percent below current levels in order to achieve a worldwide reduction of 20 percent. If China were permitted to quadruple its emissions, the industrialized countries would need to reduce theirs to zero!

In response to Dr. Richels's presentation, Jim MacNeill challenged the assumption that fuel efficiency is necessarily expensive. This has not been the experience of the "star performers" of the OECD world, such as Japan, Sweden, and West Germany. While reducing energy input per unit of Gross National product (GNP), they improved economic and trade performance, increasing GNP and per capita income. While agreeing that there will be costs in coping with global warming, Mr. MacNeill noted the need for further analysis.

Dr. Richels acknowledged that there are many factors to be considered; not only energy intensiveness, but also structural factors in the economies. He suspected that energy efficiency in those economies probably contributed to their success, and admitted the difficulty of extrapolating those numbers to predict the future.

In a discussion of the role of international institutions in responding to climate change, Peter Thacher of the World Resources Institute noted the problems of quantification and costing. He argued that "the whole system of economic accounts is a source of misleading economic signals in its inability to cope with externalities."

Dr. Metz helped to put the discussion into perspective by pointing out that there is not much resistance in the United States to 6 percent of the GNP being spent on defence, or to 12 percent being spent on health care. This question of priorities informed the unilateral Dutch decision to implement a far-reaching environmental strategy, whose costs added up to 20 percent of total extra expenditures for the year 1994. Current Dutch expenditure was said to be 8 billion guilders a year (approximately CAN $5.33 billion). This will double by 1994, and double again by the year 2010. In terms of percentage of GNP, the cost was anticipated to rise from 2 percent to 2.5-3 percent in 1994 to 3.5 percent in 2010. Dr. Metz explained that the considerable absolute increase in expenditures is masked when expressed as a percentage of the GNP because of the predicted economic growth over that period. He also pointed out the multiple environmental benefits of many of the emissions reduction strategies.

Christopher Flavin of the Worldwatch Institute described global warming as an economic as well as an environmental issue. In a discussion of energy policy and climate change, he explained that whereas cost estimates are usually single cumulative figures, they will be borne over a fairly long period of time. Seen in isolation these costs appear very high, but to put them into context, Mr. Flavin recalled that the cost of developing an oil-based economy in the post-war period was also enormously expensive. It was argued that cost effective technologies are increasingly available and that the net additional costs could be quite minor and significantly less than one percent of GNP.

A central point in Mr. Flavin's argument was that market forces and economic efficiency should guide the choice of energy technologies. Studies suggest that in the early stages of any programme, most energy efficiency investments will provide CO_2

reductions at much lower costs than new technologies. The case of the New England electric utilities end-use efficiency programme was cited as an illustration of a successful market-based and economical strategy. In the long run, however, new renewable energy technologies (for example, solar, wind, biomass, geothermal) will need to be developed.

In responding to comments on the high costs of nuclear energy, Fred Belaire of Atomic Energy Canada described nuclear power as a knowledge intensive rather than resource intensive technology, pointing out that investing in knowledge is still a good investment. Economics is based on resources and diminishing rates of return; knowledge has a positive rate of return. He also suggested that lessons learned from the global regulation of nuclear energy can be applied to our understanding of international governance vis-à-vis climate change. In addition, adapting to climate change will mean finding alternatives to greenhouse-gas energy sources, especially in developing countries. Mr. Flavin acknowledged that nuclear energy, once freed from heavy subsidies and opened to market forces, could be an economically feasible long-term option, provided it is ecologically sound.

In a broader discussion of time and economic adjustment, Mr. Flavin reinforced a number of points that he viewed as important to the development of a strategy to slow global warming. When considering the issues of climate change, it is necessary to recognize the changing and unpredictable character of the economy over a period of 30 to 50 years. He did not believe that it was possible to reverse the trend of carbon emissions in a short time, but rather that policies should plan to make adjustments over a period of decades. For this reason, proposals for carbon taxes or other environmental taxes should be levied gradually in order to limit economic damage. This would allow industry and consumers the time to adjust themselves and their investment patterns to accommodate the changes.

III CLIMATE CHANGE AND INTERNATIONAL CONFLICT

Dr. Gleick presented a wide ranging discussion on how climate change could affect international security. He clearly stated that the link between environmental problems and conflict is not necessarily direct or unicausal, but that global environmental problems, and in particular global climate change, could be expected to trigger or exacerbate international economic and political tensions. In particular, he discussed the effects of environmental problems in the areas of water resources, agriculture, population, and mineral resources, where climate change could alter access or the quality of resources, and could thus lead conflict.

Water Resources

Dr. Gleick identified fresh water resources as the area where global climate change is most likely to lead to a worsening of international relationships. These resources are widely shared and the existing conflict over international river basins (for example, the Colorado River, shared by the United States and Mexico, and the Nile, shared by nine nations) was cited as evidence that global climate change has the potential to worsen frictions and tensions.

Agriculture

Agriculture was recognized as already vulnerable to climatic variability; climate change was expected to aggravate agricultural production problems. Using the example of President Carter's 1980 grain embargo on the Soviet Union, Dr. Gleick reminded participants that agricultural and food production has been used as a policy tool, even a weapon, in the past. It is likely to be used as such in the future. Population pressures were expected to put further stress on agricultural markets and agricultural trade; global climate change can only exacerbate this stress. It was suggested that factors such as comparative advantage in food production may become more important. The availability

of foreign currency in order to purchase food on the international market may play an increasingly important role in the context of global security.

Environmental Refugees

Because some regions may become agriculturally less productive, Dr. Gleick suggested that there may be an increase in migrations away from stricken areas. In the past two decades alone, there has been a tremendous increase in the number of environmental refugees, particularly in Africa, which has experienced terrible droughts and failures in agricultural production. The problem of environmental refugees was expected to get worse, not better, partly because of changing environmental conditions and partly because of growing populations.

Sea-level rise was expected to contribute to the problem of environmental refugees. The heavily inhabited flood plains of the world are very vulnerable, especially those of the Ganges-Brahmaputra in Bangladesh, and the Nile in Egypt. Dr. Gleick argued that while large migrations may lead to border problems and further international frictions, specific circumstances will determine whether or not this leads to actual conflict. Such mass movements of people would heavily strain the already underfunded and understaffed efforts of the United Nations High Commissioner for Refugees (UNHCR).

Mineral Resources

The potential for conflict over mineral resources (whose development is already constrained by climate) seems to lie in the shifting strategic importance of new or existing reserves. The question of the growing importance of Arctic oil and gas resources is a function of total oil and gas resources. The United States, in order to reduce dependence on Middle Eastern oil, already claims national security as the imperative for developing northern oil and gas resources.

Disparate Responses to Climate Change

In a discussion of disparities in the causes and effects of and the responses to climate change, Dr. Gleick pointed out that the industrialized world bears the primary responsibility for the emissions of greenhouse gases. The impacts of climate change will be fairly evenly distributed among nations, but the ability to respond and adapt differs. Unlike Third World countries, the rich countries of the world have the resources for adapting to climate change. This disparity is already causing some North-South tension and may well become a principal source of conflict in the years to come.

Dr. Gleick concluded that although there are both technical solutions (such as energy efficiency, reforestation, water management, grain storage) and political solutions (unilateral, multilateral, and international) to these problems, there was no way to prevent at least some change in climate. And the longer we take to deal with the concentration of greenhouse gases, the more climate change we will be committed to. In this statement he echoed a recurring question throughout the conference of how much time we have to act. As Dr. McElroy pointed out in his opening presentation, if action had been taken earlier, much time would have been saved.

IV THE CHALLENGE TO INTERNATIONAL INSTITUTIONS

Fen Hampson of CIIPS introduced this session by emphasizing the enormous complexity of the policy problem, a complexity heightened by the forcing functions of energy policy, population, economics, and problems of economic and ecological interdependence. Dr. Hampson raised a number of questions that provided major points of reference for the discussion of the challenge posed to international institutions by climate change.

1) Why do we need international regimes or conventions to address the problems of climate change? Dr. Hampson argued that international regimes will be required to share information and to monitor national responses. They are also necessary in order to share the costs and risks of both adaptation and preventative strategies, as well as to provide a transfer of resources from North to South. He noted that at a minimum, regimes can be instruments of moral suasion.

2) How difficult will it be to negotiate a convention on climate change? Dr. Hampson stressed that these will be complex, multiparty, multi-issue negotiations.

3) How long will it take to negotiate a convention and what should we be doing in the meantime? Dr. Hampson mentioned the Third Law of the Sea Conference, which took some fourteen years to negotiate a regime.

4) What will be the purpose and functions of the regime? What kinds of international organizations and mechanisms will be required to manage, maintain, and develop this regime?

5) Once negotiated, can the regime be implemented? More specifically, Dr. Hampson asked what kinds of verification and monitoring mechanisms would be required to ensure that international regimes do what they are intended to do.

6) What is the role of other actors, for example, non-governmental organizations and the private sector, in negotiating, building, and maintaining new international regimes? Dr. Hampson pointed out that non-governmental organizations, particularly in the scientific community, played a significant role in establishing the ozone protocols.

Negotiating a Convention on Climate Change

David Fransen of the Privy Council Office wondered whether a large part of the negotiation and drafting work for a convention on climate change was not now under way in another context: the Uruguay round of negotiations for the General Agreement on Tariffs and Trade (GATT). It was suggested that issues such as the reciprocal rights and obligations affecting national economic welfare, the trade related intellectual property question, and access to technology were already being negotiated in GATT. The work completed by 1990 may be transferable to the conference on a climate change convention. This was also suggested in an address by Arthur Campeau, Special Advisor to the Minister of the Environment, who agreed that GATT may provide some lessons in the search for models for new institutional arrangements. Mr. Wood suspected that the GATT process is more useful as an analogy than as an exact application. It was noted, however, that this type of creative approach to new institutional problems will be essential in the future.

Edward Lee of the Department of External Affairs identified a number of issues to be decided in the negotiation of the convention:

1) The political imperative of striking a correct balance between the need for a far reaching, action oriented framework convention and the need for urgent adoption of a convention in order to begin tackling the problem of climate change.

2) The extent to which specific obligations, particularly on controlling emissions of CO_2 and other greenhouse gases, should be included either in the convention itself or in separate protocols.

3) The timing of the negotiation of such protocols in relation to the negotiation of the framework convention.

Mr. Lee told the conference that the Canadian report submitted to the Intergovernmental Panel on Climate Change highlighted some of the important issues, including the financial needs of developing countries and their requirements for new and additional resources; technology transfer and the provision of technical assistance to developing countries; and the role and power of new institutions created by the convention.

World Atmospheric Trust Fund

The beneficiaries of a trust fund would be developing countries, who would be assisted in paying for programmes to control pollution. Mr. Lee said that monies for the fund could come from three possible sources: contributions by countries, either voluntary or assessed (from those countries party to the treaty); user fees for those activities that cause climate change; and fines for violations of the convention.

Mobilization of Shame

Mr. Lee described an interesting proposal to help ensure the implementation of a convention on climate change: the "mobilization of shame." The convention should include periodic reports by each party describing in detail its progress or lack of progress in meeting the goals and obligations of the conventions. These reports could be analyzed by an independent group of qualified experts and then transmitted through a conference of the parties held annually or bi-annually. The attention of the international community would facilitate the mobilization of shame and thus assist in implementing the convention.

UNDP as an Environmental Institution

Peter Thacher noted that there were a number of proposals for the creation of a "new authority." He thought that it was not feasible to expect the UNEP governing council (with a current operating budget of $30 million) to assume responsibility for policy development requiring a much larger budget than could ever be incorporated into UNEP's fund. He identified the United Nations Development Programme (UNDP) as a more suitable institution. In May 1989 the UNDP administrator reported to his governing council that in the previous year it had run a programme of some $300 million in identifiably environmental projects; the current figure is $500 million. Mr. Thacher considered this figure very small when compared to resources flowing from the World Bank and other multinational development funding agencies. Governments were said to be seeking a way to exert better policy direction over the much larger funds needed to influence action at the national level, where the process of global change originates.

Remote Sensing

Mr. Thacher advocated the use of remote sensing and geographic information system analytical techniques as early warning mechanisms of environmental problems. These techniques could be a means of combining real-time measurements of surface

changes with conventional social and economic data. Mr. Thacher suggested that the world needs a new IntelSat, a new consortium for an internationally operated, nonprofit satellite system that would do more than verify arms control measures. Four years ago during the African emergency, an information system was set up that included real-time reporting of refugee movements as well as information on infant mortality and nutritional stress. One operational early warning system, the Famine Early Warning System (FEWS), was based on meteorological satellite data on the vitality of vegetation, and was used to suggest how best to mobilize and shift food, medical, and other supplies in advance of the need.

V ENSURING INTERNATIONAL COOPERATION

Mr. Thacher agreed with Peter Gleick that the industrialized world is largely responsible for past and current emissions of greenhouse gases. But he argued that when the contributions of other gases, as well as the biotic contribution to warming is considered (which is at least 20 percent of the carbon emissions from deforestation), it is clear that slowing the rate of global warming can no longer be resolved by the industrialized countries alone. This is particularly true when you add in demographic projections. He cited an upcoming World Resources report, which predicts that in another 30 to 40 years, the Third World's contribution of greenhouse gases will be equivalent to the industrialized world's current contributions.

Third World Participation

Jim MacNeill believed that it was unrealistic to expect developing countries to cooperate on global warming and other issues if the economic, trade, and other policies of industrialized countries continue to deny the Third World access to an equitable share of the benefits of modern technology and world development. Furthermore, he argued, it was unreasonable to expect the developing world to forego the energy development needed for economic growth just at a time when many countries are making concrete advances in social and economic development.

Mr. MacNeill identified two avenues that the industrialized countries must be prepared to take if they want developing countries to cooperate on climate change. First, the industrialized countries must enable developing countries to occupy an equitable share of the global ecosystem. This means the right to an equitable share of the limited space available to accommodate greenhouse gas emissions and especially carbon emissions from fossil fuels. Second, industrialized countries must recognize that in many developing countries, coal is the cheapest available fuel. If industrialized countries want developing countries to forego the use of this highly polluting fuel, one or more OECD countries

should negotiate a number of "straight bargains" to provide alternative energy technologies, the means to develop them, and compensation for the incremental costs associated with those technologies.

The question of how to fund such bargains was highlighted as critically important. Mr. MacNeill tentatively estimated that international funding of up to $20 to $30 billion a year may be needed (using the lowest cost measures available). To put this figure in perspective, he noted that although it seems an enormous amount compared to the $30 million UNEP receives annually, it is only .02 percent of the gross world product, or only about 50 percent of the annual cost of the subsidies now provided by Canada and the United States to the fossil fuel industry. According to a recent Dutch study, the cost of a series of smaller bargains involving Third World or East European countries was estimated at $50 to $500 million a year.

Mr. MacNeill made an observation widely shared by other participants: some developing countries have clearly come to the conclusion that the second wave of environmental concern now sweeping Europe, North America, and Japan provides them with political leverage, however negative, that they can use for bargaining for action on those things that concern them most. This, he said, is already evident in the negotiations to strengthen the Montreal Protocol (for protection of the ozone layer) and the negotiations on climate change.

Like Mr. MacNeill, Peter Thacher stressed that the success or failure of the industrialized countries in negotiating cooperation on these issues depends on the credibility of their position. Under the present conditions of international indebtedness and the marginalization of the developing world by Eastern Europe, Mr. Thacher thought that it was unreasonable to expect developing countries to negotiate without better assurances than they have had in the past. Because of the high level of distrust, the only way to negotiate agreements with developing countries is to provide contractual assurance as embodied in an international treaty.

Allocating Environmental Aid

Within the context of North-South relations, David Runnalls of the Institute for Research in Public Policy emphasized the distinction between economic and political criteria for the allocation of environmental aid funds. He argued that a rational set of criteria for the allocation of monies would put Eastern Europe foremost on the list because of its high emissions. While this may make good economic and environmental sense, Mr. Runnalls argued that it shows poor judgment in terms of international politics because it diverts attention from developing nations such as Egypt, Brazil, Mexico, China, and India (and the rest of the Third World), who may not count in terms of carbon emissions, but who do count in political terms.

Education

Dr. Roots suggested that if a collective attempt were made to institute the national and international changes being discussed, more effort would be needed in fostering compatible understanding and international awareness in the North and South. He pointed out that the necessary mechanisms were already in place in the form of UNESCO, one of the main channels into the educational systems of the Third World, but he was not aware of any efforts to integrate climate change and environmental issues into UNESCO's education process. Unless "compatible awareness" of environmental issues is developed in the First, Second, and Third World, then little progress will be made.

VI POLICY ISSUES AND PROBLEMS

Conference participants pointed out the very small distance that most countries have moved in responding to environmental problems since the Toronto Conference.[2] As Mr. Flavin and others including Mr. Runnalls pointed out, there appears to be a large and growing gap between the rhetoric of some leading policy makers and the actual policies on the table. Leadership is moving forward in a few countries, but Mr. Flavin called the overall progress disappointing.

Political Obstacles

Mr. Flavin went on to address the political implications underlying effective policy formulation in environmental issues. As an example, he pointed to the target of a 20 percent reduction in global carbon emissions (from 1988 levels) set at the Toronto Conference. Trends indicate that not only will the target not be met, but if nothing is done, levels may well increase by 70 percent or more over the next few decades. Since 1988 worldwide emissions have increased by approximately 6 percent. It was argued that the conference target was formulated on the basis of what the climate needs, not on what politicians are ready to accept or what economists are willing to put into their econometric models. It was stressed that current energy policies often exacerbate growth trends in carbon emissions. Energy policy formulation is still the domain of a handful of industries and interests who set the agenda at the expense of broader societal and ecological interests. These same industries constitute what Mr. MacNeill labelled powerful "blocking coalitions," which hinder any attempt to reduce oil, gas, and coal production. Mr. Lee noted a similar obstacle in the politics of acid rain, where scientists have been misused by their political masters. The challenge in the years ahead,

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[2] The Changing Atmosphere: Implications for Global Security, 27-30 June 1988 (Toronto: World Meteorological Organization, publication no. 710, 1989). This international conference was sponsored by the Canadian Government, the United Nations Development Programme, and the World Meteorological Organization.

according to Mr. Flavin, will be to deal with energy policy issues despite political "stacked decks."

Mr. Flavin also argued that even the analytical side (for example, economic studies) has been commandeered by political interests. As environmental issues become more prominent, the question of what is fair analysis and what is industry-generated propaganda will become increasingly difficult for policy makers to determine.

Gary Webster of the Canadian Petroleum Association (CPA) argued that industry is also committed to solving the problem of global warming through efficient production, efficient consumption, and the reduction or recovery of emissions gases. He suggested combining forces with government in order to provide the public with scientific rather than subjective and highly emotional information (which too often dwells on public fears) and to develop better indicators of environmental quality. While agreeing with the sense of urgency which pervades environmental issues, he pointed out that significant technological change means significant business risk, which is neither cheap nor quick. Although using the marketplace to develop new technologies is a necessity, this option will work only if the public has confidence that industry is practising environmental management.

Sustainable Development

An obstacle identified by Jim MacNeill was the misunderstanding of the concept of sustainable development. Some of this confusion was seen as inevitable and normal. ut Mr. MacNeill also believed that part of the confusion was driven by self interest and he intent to deceive. He saw a transition to more sustainable forms of development as a precondition for further growth, and even for survival.

Mr. MacNeill also called for the creation of more precise indicators of sustainable development. He indicated that some work is underway and expressed hope that this soon would result in some solid indicators. Mr. MacNeill believes that indicators of

sustainable development already existed under different guises, noting that policies which promote increases in energy resource efficiency often promote more sustainable forms of development as well. In addition, economies that show yearly increases, however small, in energy efficiency or water-use efficiency are economies moving in the direction of greater sustainability. By the same token, an economy that uses more energy to produce a unit of GNP and more water to produce a ton of steel, should be recognized as one moving in the direction of more unsustainability.

In the broader context of intersecting policy environments, Mr. MacNeill explained that Third World sustainability and hence global sustainability would not be realized if we do not slow population growth rapidly and soon, solve the growing debt problem, especially in Africa and Latin America, drop protectionist barriers against Third World products, and increase aid. He pointed out that this could be accomplished at a cost far less than the cost of doing nothing.

The Gap between Science and Politics

Dr. Roots pointed to the gap between science and politics as another obstacle. One of the difficulties of mobilizing scientific actions to be more relevant to environmental questions is that the policy decision-making network in developed countries is nearly always separate from the scientific network. Dr. Roots thought that although it was within the power of most developed countries to repair this gap, very little had been done to address it. The scientific agencies are usually left to make the scientific case first and then try to convince the political groups of the need for that science. The problem is that resources are not directly connected to this task. It was observed in contrast, however, that the North-South collaborative scientific data gathering and research contacts were good.

Unilateral Action

The problem associated with unilateral action was introduced by Gil Winstanley of Energy, Mines and Resources. Without widespread commitment to response action, a problem could arise where action by one state may be counteracted by the actions of another. Dr. Winstanley saw a danger in that the problem could be perpetuated by positive economic feedback. That is, if some countries implemented environmental action plans, there may be economic incentives for other countries not to act, because they would still reap the benefits of other countries' actions.

Canada's Credibility

The issue of Canada's credibility as an environmental leader surfaced on numerous occasions. The concern for declining Canadian credibility was articulated by David Runnalls, who, like Mr. MacNeill and Mr. Flavin, expressed disappointment that since the Toronto Conference there has been a divergence of Canadian international policy and domestic policy, or as he called it, "non-policy" on climate change. Mr. Runnalls suspected that ultimately Canada's ability to effect change will be directly related to how the outside world perceives its willingness to make serious changes at home. He thought that the environmental agenda is still a natural area for Canadian leadership, but that this particular set of issues is different from ones where Canada has previously provided leadership. In those cases, domestic policy was either not important or else coincided with our own international positions and aspirations. Mr. Runnalls concluded on an ominous note: "Here is one area where we quite obviously have to put our money where our mouth is, and soon."

The Population Link

Paul Demeny of the Population Council stressed that the element of population size in the carbon emissions equation should be taken more seriously. He suggested that the proposition held by technological optimists that better availability of contraceptive services would reduce fertility should be vigorously tested. The UN and OECD estimates of the cost to bring birth-control practice to a much higher level was described as relatively small: "a couple of billion dollars." Dr. Demeny noted that the UN Fund for Population is bidding for a 7 percent annual increase in the real contributions from the OECD countries to population programmes, which would double the present annual level of funding within the next ten years. In the short term, population growth holds back development, which means smaller contributions to carbon emissions. In the long term, however, the expectation is that development must succeed, which means an increase in emissions. According to Dr. Demeny, demography has its own logic and the consequences must be addressed in any policymaking on climate change. He identified adequate funding as an essential starting point in dealing with climate change.

VII POLICY INSTRUMENTS

The Canadian Environmental Plan

Elizabeth Dowdeswell of Environment Canada provided her views of Canadian efforts to deal with environmental problems. She pointed out that Canada is trying to construct a different kind of conceptual framework for responding to environmental problems. She said that the Canadian Government's Green Plan addresses the need for changing course in order to implement sustainable development: it considers a range of issues, including the relationship between science and technology; the need to generate and disseminate environmental information effectively; the use of legislation and regulation as policy instruments; and economic instruments and market forces as complements to regulation.

Ms. Dowdeswell concluded that there are two fundamental issues to be addressed. First, Canada must link international and domestic policy. Second, Canada must link science to policy formulation, and at the same time being aware of both short and long term contraints and opportunities.

Dispute-Resolution Mechanisms

In a discussion on the linkages between environmental degradation and international conflict, Peter Gleick stressed the need for policy makers to identify the environmental problems that seem most likely to lead to international frictions and tensions. He suggested the development of dispute resolution mechanisms which explicitly take into account growing environmental problems. As he had pointed out earlier, no international river treaty takes into account climate-induced shortages or climate-induced flooding. These could be fairly easily incorporated into international agreements, especially if negotiations were concluded prior to the effects of climate change. Dr. Gleick warned that if countries waited until climate-induced shortages

occurred (though there are questions as to how to identify such shortages), then resolution of disputes will be that much more difficult.

Mr. Lee added that the international climate convention now being formulated would need to include provisions for the peaceful settlement of disputes. He suggested formal negotiating mechanisms, mediation or conciliation, as well as compulsory arbitration or a judicial settlement before either a separate court or the International Court of Justice.

Fuel and Conservation

Mr. Bruce articulated a need commonly accepted by conference participants: the single most important step in reducing any contamination of the global atmosphere, including global warming, is to produce and use less energy and fossil fuels. This would entail the adoption of far more fuel-efficient vehicles, major domestic and industrial energy conservation efforts, and switching to non-fossil fuels as much as is practically possible.

Carbon Tax

The imposition of a carbon emissions tax was frequently suggested. Dr. Richels argued for a tax on the activities responsible for carbon emissions, which could be varied according to the carbon content of individual fuels. The purpose would be to discourage activities with relatively high carbon emissions. In his model, he calculated the size of the carbon tax that would be required in each of the worlds regions included in his study to induce consumers to reduce their dependence on carbon-based fuels. Under Dr. Richels's assumptions, the long-run equilibrium tax would be the same in all regions: $250 per ton of carbon. Dr. Richels pointed out that there are significant regional differences in how long it would take to reach the long-run equilibrium tax level. At a given point those regions that found it more difficult to adjust their carbon limits should be willing to purchase emissions rights from other regions experiencing less difficulty.

If one region were to sell just 100 million tons of carbon emission rights to another, this tax rate would generate a financial transfer of $25 billion annually.

Enforced High Energy Prices

One commentator suggested that the oil price shocks of the early 1970s might be a useful basis for determining the impact of enforced high energy prices on the economy, society, and policy. It was argued that this was essentially an energy policy imposed on the world by the oil cartel. The imposition of this "policy" and the artificially raised price of oil stimulated tremendous advances in energy efficiency and research on alternative sources. One commentator asked whether we could learn from that policy, and whether artificially increasing oil prices once again would be an effective way to solve many of the problems being addressed.

In responding, Mr. Flavin agreed that the question could initiate "quite an interesting study" that would show how much further we would be economically in the long term, but also in terms of limiting carbon emissions if we had stayed at these relative high energy price levels. He used Sweden as an example of a country with a carbon tax in place, pointing out that the result is a set of policies with many advantages. A government-levied carbon tax recycled for useful investments within the economy was viewed as better, from an economic point of view, than sending that same amount of money abroad to pay for imported oil from foreign oil suppliers. Mr. Flavin argued that the damage done to the global economy by the shock was largely due to its having been imposed suddenly.

Subsidies

Many conference participants called for a political and economic "levelling of the playing field." Subsidies attracted particular attention. According to Jim MacNeill, comparing $40 to $50 billion a year spent on subsidies in North America to promote fossil fuels (and hence to promote acid rain and global warming), to the decreasing

amounts spent on energy efficiency and alternatives to fossil fuels, is simply "no contest," the victory going to acid rain and global warming. He also noted that the elimination of these subsidies to level the playing field for energy-efficient technologies and alternative energy sources would have the added benefit of significantly reducing the national debt in both Canada and the United States. Mr. MacNeill cited Dutch, Swedish, American, and Canadian studies suggesting that most measures to reduce carbon emissions are economically attractive to society because of energy savings alone. Ascribing an economic value to the environmental benefits associated with these measures would simply make them even more attractive. The obstacles in this case are political.

The argument that economic soundness and market forces should be a guiding principle of environmental policy action raised the more fundamental and contentious question of whether subsidies should be a policy instrument at all, and if so, what should be subsidized. Mr. MacNeill reflected the view shared by a number of delegates when he argued that subsidies that encourage ecologically damaging production processes (for example, the OECD agricultural subsidies that reinforce the overuse of soils, wood, and other resources) should be either scrapped or made ecologically sensitive. Mr. Flavin argued that levelling the playing field would require stopping the current subsidization of ecologically unsound production and providing limited subsidies to ecologically sound production and technologies. A third point of view stated that a subsidy is a subsidy; hence levelling would mean eliminating subsidies. The debate, though animated, was inconclusive.

Reforestation

Dr. Maini cited the need for international collaboration in reforestation. Forests constitute important carbon reserves: about 86 percent of global, above-ground carbon resides in forests; about 73 percent of soil carbon is contained in forest soils. Many delegates at the Toronto Conference supported massive reforestation programmes. Some

of the estimates for the programmes call for the planting of 465 million hectares around the world at the cost of $375 billion. Dr. Maini argued that compared to the estimated $300 billion worth of damage caused by Chernobyl, the cost of reforestation and the creation of this massive carbon reservoir is not unreasonable. It was acknowledged, however, that the creation of a carbon reservoir through reforestation makes environmental and economic sense, but is not a permanent solution since it would merely dampen the evident trends.

Technology Transfer

Many delegates argued that Third World countries should have preferential access to intellectual property and technology. Jim Bruce, however, indicated that his recent discussions with representatives of the World Intellectual Property Organization suggested that the international treaties concerning intellectual property not only make it difficult to transfer technology to developing countries, but actually prohibit the transfer freely or at low prices.

Jim MacNeill supported Mr. Bruce's point, saying that it exposed the hollowness of a number of clauses in treaties that commit the industrialized world to a transfer of intellectual property and technology to developing countries. Again commenting on credibility, he concluded that it is not surprising to find developing countries viewing these "solemn commitments" with a high degree of scepticism. He argued that we must either change the original treaties or find ways around them in order to deal with these issues. As well, we must find ways to transfer intellectual property and technology on a clear preferential basis, perhaps actually financing the preference.

The Dutch Environmental Plan

Dr. Metz presented an outline of the means by which the Netherlands intended to achieve the emission-reduction targets of its environmental programme. The plan uses sustainable development as a fundamental principle and integrates environmental with

all other policies. He explained that a whole series of policy instruments would be applied, combining regulatory policies, such as modification of the building code, and economic incentives, such as subsidies, assistance to the commercial sector to achieve reduction, fuel switching, and tax breaks. Dr. Metz said that the Netherlands had also implemented a carbon tax, in addition to already existing fiscal and environmental taxes. This revenue is to be channelled back into the energy sector to support subsidies and tax breaks. As well as unilateral action, the Netherlands is actively promoting technology transfer and institution building in developing countries. Dr. Metz stressed that because funding is crucial, the country is also supporting (in addition to existing channels) a CFC and climate trust fund.

APPENDIX I

NOTES FOR AN ADDRESS DELIVERED ON BEHALF OF THE HONOURABLE LUCIEN BOUCHARD, MINISTER OF THE ENVIRONMENT BY ARTHUR CAMPEAU SPECIAL ADVISOR ON INTERNATIONAL AFFAIRS

CANADIAN INSTITUTE FOR INTERNATIONAL PEACE AND SECURITY

RADISSON HOTEL, OTTAWA

APRIL 11, 1990

Ladies and Gentlemen:

It gives me great pleasure to talk with you this evening, on behalf of Environment Minister Lucien Bouchard, about how climate change could affect global security and international governance. The relationship between environment and society is vital to the today's conference on their decision to focus on this issue.

Global warming poses a major threat to the entire world's economic well-being and security. That threat offers an unprecedented challenge to the political will of the international community.

The consequences of global warming have been described as second only to those of global nuclear war. Fortunately, as tension between the superpowers diminishes, the threat of global nuclear war recedes. Now is the time, therefore, to turn our resources and energies towards meeting the threat of global warming -- a process that could undermine world security more slowly, but just as tragically, as a nuclear holocaust.

The challenges we face are many. First, the sheer scale of the problem is such that the effects of climate change are truly global. None can escape its consequences.

Second, the change, in practice, is almost irreversible. It is a relatively simple task to take carbon out of the ground, burn it, and so put it into the atmosphere. It is much more difficult to recapture that carbon and store it in a safe place. Massive reforestation programs would be required to absorb present carbon dioxide emissions; and we are, I need hardly remind you, still far from even controlling deforestation.

As a result of past actions, we have already committed ourselves and our children to a different climate. This problem cannot wait for traditional reactive solutions taken after all the scientific and economic evidence is in.

Third, climate change is inextricably linked to economic growth. A five-fold expansion of the global economy, which will be needed simply to meet the needs of the global population predicted for the year 2000, cannot take place without major increases in the amount of energy used by developing countries. Almost all present forms of energy produce carbon dioxide. Accordingly, our efforts to minimize climate change will strike directly at the prospects of developing nations.

Now, the link to global security becomes clearer. Climate change is about inequity. It has been caused by some nations and not by others. It will provide opportunities for some and pose difficulties for others.

While we may see a climate system that is capable of meeting the world's needs for food on a global basis, the regional distribution may be altered significantly. The increased length of a growing season in one part of the world may be offset by more frequent droughts elsewhere. Sea-level rise and ice melt may make some northern communities more accessible, but the very existence of other countries, like Bangladesh, may be in jeopardy.

Climate change places in sharp focus the problems of poverty and the needs of developing countries. Reducing inequities among nations is central to any appropriate response to the climate change issue.

And it is not only the problem of inequity today that has to be addressed. The shadow of our current circumstances is cast far into the future. Unless we act now, it is probable that global inequity will be increased by climate change.

It is almost certainly already too late to prevent some global warming. So international action will have to include remedial or adaptive responses, as well as steps to limit future climate change.

Agreement and action is needed by all parts of the international community. The problem cannot be solved by a few nations, however rich and powerful, acting in concert. All nations, rich and poor, East and West, North and South, have to be involved in finding the way ahead.

If even some of the predicted consequences of climate change are realized -- the large scale dislocation of persons in coastal areas, for example -- it is not difficult to predict the consequent increase in international tensions and perhaps even international conflicts. These will not simply involve neighbours struggling for scarce resources and Canada will not be immune from such conflict. Major changes in food production patterns will be seen ultimately as the fault of the northern industrial countries. Similarly, the flooding of coastal zones, including densely populated delta land in the tropics, will be laid at the door of high-energy-using countries, including Canada.

We have to reach agreements on the control of carbon dioxide and other greenhouse gas emissions. But developing countries, naturally, resist any conditions being imposed on their development.

We can confidently anticipate difficulty reaching agreements about the costs of limitation strategies and who will bear them. The demands for additional financial assistance to developing countries will be significant and will not be easy to meet.

In the absence of worldwide co-operation, the mixture of global inequity with the threat of major environmental disruption becomes explosive. This is the new and major threat to international security.

In this century, Canada has played a prominent and important role in the promotion of international security. We have a preeminent reputation as a peace-keeping nation, and to this end we have deployed our armed forces in many parts of the world, usually under a United Nations flag. Our role in the Commonwealth and la Francophonie has enabled us to be an influential international mediator. And, of course,

in environmental matters, we played major roles in the Law of the Sea negotiations, and in the development of the Montreal Protocol on substances that deplete the ozone layer.

Today, Canada stands ready to use its influence and experience to help remould the perception of international security. New international arrangements are needed to deal with the looming, global threats to the environment. An improved system of international governance and a new purpose for collective security has to be developed. How can Canada best help to bring this about? What proposals for change should we develop and put forward internationally?

It is clear to all that our existing international institutions are inadequate to deal with the complex global environmental issues of today. Present-day institutions will have to be modified. New institutions may be required, if only to administer new international agreements.

Suggestions to date include strengthening the United Nations Environment Programme, creating a new Council at the highest levels of governments, such as an Environmental Security Council, and redirecting the Trusteeship Council to provide a trusteeship function for the global environment.

Let me suggest one more. In seeking models for new institutional arrangements, perhaps we should look to GATT, the General Agreement on Tariffs and Trade. Because it is a major international convention embracing 100 nations, embodying reciprocal rights and obligations affecting national economic welfare and massive international exchanges, GATT may have some lessons for us.

A similar agreement, for the environment, might be directed towards sustainable development. Like liberalized international trade, however, sustainable development cannot be realized instantly. We have to move forward step-by-step.

And both concepts are in evolution. For example, what we define today as environmentally sustainable development in terms of the atmosphere will change as more scientific evidence comes in. There will always be a need to advance the international consensus, just as we are now engaged in the Uruguay Round of GATT negotiations.

GATT itself does not prevent regional movements toward free trade, such as the Canada-US Free Trade Agreement or the Single European Act of 1992. Furthermore, GATT has its own internal mechanisms for dispute mediation and resolution. Perhaps we could learn something from its operations.

Canada is now working, in many ways, to address the issue of climate change. We are working through the Intergovernmental Panel on Climate Change to prepare for the negotiation of a framework convention on climate change. Our scientific leadership and environmental diplomacy will, we hope, contribute to the realization of a signed convention at the UN Conference on Environment and Development, to be held in Brazil in 1992.

Domestically, we are developing The Green Plan. On March 29, the government released a discussion document, seeking participation from all levels of society, and leading to the formulation of legislation, regulations, and new, improved programs on environmental matters. The principal theme of The Green Plan is to make Canada, by the year 2000, the industrial world's most environmentally friendly country.

At the recent meeting of the Canadian Council of Ministers of the Environment, Environment Ministers agreed to develop a comprehensive National Action Strategy for climate change. It would encompass strategies to limit and/or reduce greenhouse gas emissions, incorporate strategies appropriate for federal, provincial, territorial, and municipal governments, as well as industry and, most importantly, individuals. The Canadian Strategy would provide a response to such reports as the Intergovernmental Panel on Climate Change, the Parliamentary Standing Committee on the Environment and other similar bodies. Furthermore, it builds upon actions already underway, including

Canadian contributions to the reduction of the scientific uncertainties associated with climate change.

We are convinced that the unprecedented challenge that we face is also an unprecedented opportunity. We can and must create a new global compact between East and West, North and South. Indeed, we have no choice but to find the common will to define a new, united international order.

The developed world must recognize its responsibilities and obligations. We must accept our share of the responsibility for global environmental problems engendered by our patterns of production and consumption. And developing countries must, as full partners in the development of international solutions to global problems, choose sustainable paths to development.

Achieving international consensus on arrangements for the transfer of technology and the provision of financial and technical assistance is essential.

Let us not be afraid to examine new options.

The challenge is more than institutional. It goes to the root of our life as nation states. Since a new level of global co-operation is needed, we will not make progress if nation states cling tenaciously to outdated notions of sovereignty. It is not yet clear how to advance to the next stage in the evolution of global society. We need new ideas and new concepts. Can the idea of the global commons, or the common heritage of mankind, be adapted to deal with climate change and security?

These are some of the questions we must collectively consider. I thank you for inviting me. I wish you every success in your deliberations and look forward to hearing from your conclusions.

APPENDIX II

CLIMATE CHANGE, GLOBAL SECURITY, AND INTERNATIONAL GOVERNANCE

April 11-12, 1990

DAY 1 Minto Hotel (Stanley-Vanier Rooms)

9:00 a.m. Introductory Remarks -- **Bernard Wood**, Chief Executive Officer, Canadian Institute for International Peace and Security

Climate Change as an International Security Issue

9:30 a.m. The Science of Climate Change

CHAIR: **Honourable David MacDonald, M.P.**, Chairman, House of Commons Environment Committee

Michael B. McElroy, Chairman, Department of Earth and Planetary Sciences, Harvard University, Cambridge

Fred Roots, Science Advisor Emeritus, Office of the Science Advisor, Department of the Environment, Hull

10:30 a.m. Refreshment Break

10:45 a.m. Potential Security Conflicts: Food, Water Resources, Environmental Refugees

CHAIR: **Paul Painchaud**, Director, Groupe d'étude des politiques et de recherches environnementales, Université Laval, Ste. Foy

Peter Gleick, Director of the Global Environment Programme, Pacific Institute for Studies in Development, Environment and Security, Berkeley

Key Elements of the Problem and Policy Equation

11:45 a.m. Energy Policy and Climate Change: Issues

CHAIR: **Jim Bruce**, Chairman, Canadian Climate Board

Richard Richels, Manager, Environmental Risk Analysis, Electric Power Research Institute, Palo Alto

1:00 p.m.	Luncheon at CIIPS
2:00 p.m.	Energy Policy and Climate Change: Responses
	CHAIR: **Gil Winstanley**, Director, International Energy Relations, Energy, Mines and Resources Canada
	Christopher Flavin, Vice President for Research, Worldwatch Institute, Washington
	Fred Belaire, Corporate Economic Advisor, Atomic Energy Canada Ltd., Ottawa
3:30 p.m.	Population Policy and Climate Change: Issues and Responses
	CHAIR: **Digby McLaren**, President, Royal Society of Canada
	Paul Demeny, Distinguished Scholar, Population Council, New York
4:15 p.m.	Refreshment Break
4:30 p.m.	Sustainable Development
	CHAIR: **Nancy Gordon**, Director, Public Programmes, CIIPS
	James MacNeill, Director, Sustainable Development Program, Institute for Research on Public Policy, Ottawa
	Jagmohan S. Maini, Assistant Deputy Minister (Policy), Forestry Canada, Hull
7:00 p.m	Radisson Hotel, Cocktails (Commonwealth Ballroom-South)
8:00 p.m.	Dinner -- Global Warming and International Security
	Hon. Lucien Bouchard, Minister of the Environment (Replaced by Arthur Campeau, Special Advisor to the Minister of the Environment.)

DAY 2 Minto Hotel (Stanley/Vanier Rooms)

The International Institutional Challenge and Implications for National Policy

9:30 a.m. Negotiating a New International Regime on Climate Change

CHAIR: **Fen Hampson**, Associate Professor, The Norman Paterson School of International Affairs, Carleton University, and Research Associate, CIIPS

Edward Lee, Legal Advisor and Assistant Deputy Minister for Legal, Consular and Immigration Affairs, Department of External Affairs, Ottawa

10:30 a.m. Refreshment Break

10:45 a.m. Reforming International Institutions

CHAIR: **Adriaan de Hoog**, Director, Energy and Environment Division, Department of External Affairs

Peter Thacher, Senior Counselor, World Resources Institute, Washington

12:00 p.m. Luncheon, Radisson Hotel (Commonwealth Ballroom South)

Climate Change and the North-South Relationship

Eunice Ribeiro Durham, NUPES, University of Sao Paulo, Brazil (Dr. Durham was prevented from attending the conference at the last minute.)

2:00 p.m. Linking International with National Responses to Climate Change

CHAIR: **Bernard Wood**, Chief Executive Officer, CIIPS

Gil Winstanley, Director, International Energy Relations, Department of Energy, Mines and Resources, Ottawa

Bert Metz, Counsellor for Health and Environment, Royal Netherlands Embassy, Washington

Gary Webster, Senior Coordinator, Safety, Health and Environment, Canadian Petroleum Association, Calgary

David Runnalls, Associate, Institute for Research on Public Policy, Ottawa

Elizabeth Dowdeswell, Assistant Deputy Minister, Department of the Environment, Ottawa

Conference adjourns

APPENDIX III

CLIMATE CHANGE, GLOBAL SECURITY, AND INTERNATIONAL GOVERNANCE

Ottawa, 11 and 12 April 1990

PARTICIPANTS

NAME	ORGANIZATION	CITY
Marie Adam	Federal Environmental Assessment Review Office	Hull
Angus Archer	United Nations Association in Canada	Ottawa
Peter Aykroyd	Milleniad Consultant	Sydenham
Fred Belaire	Atomic Energy Canada Ltd.	Ottawa
Bryan Bertie	Conservation Council of Ontario	Toronto
David Braide	Chairman, CIIPS Board of Directors	Toronto
Ronald Bright	Ford Motor Company of Canada	Oakville
Jim Bruce	Canadian Climate Board	Ottawa
James Bryne	University of Lethbridge	Lethbridge
Ian Burton	International Federation of Institutes for Advanced Study, Environment Canada	Toronto
Ken Bush	CIIPS	Ithaca
Ian Cameron	CIIPS	Ottawa
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Giacomo Capobianco	Coal Association of Canada	Calgary
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Ann Dale	National Round Table on the Environment and the Economy	Ottawa
Alex Davidson	Institute for Research on Public Policy	Ottawa
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David Fransen	Privy Council Office	Ottawa
Anthony Friend	University of Ottawa	Ottawa
Peter Gleick	Pacific Institute for Studies in Development, Environment and Security	Berkeley

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Samantha Hayward	CIIPS	Ottawa
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Ivan Head	International Development Research Centre	Ottawa
Derek Ireland	Consumer and Corporate Affairs	Hull
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James MacNeill	Institute for Research on Public Policy	Ottawa
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Gary Webster	Canadian Petroleum Association	Calgary
Gwenda Wells	Anglican Diocese of Ottawa	Ottawa
Gil Winstanley	Energy, Mines and Resources Canada	Ottawa
Gregory Wirick	Parliamentary Centre for Foreign Affairs and Foreign Trade	Ottawa
Bernard Wood	CIIPS	Ottawa